

USER'S HANDBOOK

1061A 1061

1071

datron
INSTRUMENTS

digital voltmeters

1061 and 1061A [5] Specifications

DC VOLTAGE

Full Range Count (FR) : $\pm 100,000$ (1,000,000)
 Full Scale Count (FS) : $\pm 199,999$ (1,999,999) on all ranges
 except 1000V range
*Superfast Mode Full Scale Count : 19,999 on all ranges
 except 1000V range*

ACCURACY

24 HOURS (23°C $\pm 1^\circ\text{C}$)	Relative to calibration standards.
*0.1V range:	$\pm 10\text{ppm}$ of reading ± 2 digits (16)
1 and 10V ranges:	$\pm 5\text{ppm}$ of reading ± 1 digit (8)
100 and 1000V ranges:	$\pm 10\text{ppm}$ of reading ± 1 digit (8)
90 DAYS (23°C $\pm 5^\circ\text{C}$)	
*0.1V range:	$\pm 30\text{ppm}$ of reading ± 2 digits (16)
1 and 10V ranges:	$\pm 20\text{ppm}$ of reading ± 1 digit (8)
100 and 1000V ranges:	$\pm 30\text{ppm}$ of reading ± 1 digit (8)
1 YEAR (23°C $\pm 5^\circ\text{C}$)	
*0.1V range:	$\pm 45\text{ppm}$ of reading ± 2 digits (16)
1 and 10V ranges:	$\pm 30\text{ppm}$ of reading ± 1 digit (8)
100 and 1000V ranges:	$\pm 45\text{ppm}$ of reading ± 1 digit (8)

Superfast Mode (all ranges) : \pm above ppm of reading ± 1 digit

TEMPERATURE COEFFICIENT : (10°C to 35°C)
 1/10th of 90 DAY specification $\pm 0.2\mu\text{V}/^\circ\text{C}$

READ RATE

Normal Mode
 All DC ranges : 3/second (internal trigger) with full scale input
 30/35 per second (external trigger) with full range input at 50/60Hz
Superfast Mode
All ranges: 200/second (external trigger) with full range input.

SETTLING TIME (to 10 ppm of step size) [1]

Filter out : $< 5\text{mS}$
 Filter in : $< 350\text{mS}$

SERIES MODE REJECTION

Filter out : 66dB @ line frequency
 Filter in : add 34dB @ 50Hz increasing at 18dB/octave

COMMON MODE REJECTION

1k Ω source unbalance
 > 140dB at DC
 > 80dB + series mode at 1Hz to 60Hz

AUTORANGE SPEED (No filter)

Typically 100mS per range between top and bottom ranges.

INPUT RESISTANCE

0.1 to 10 Volt ranges (< 20 volts) : $> 10,000$ M Ω
 100 and 1000 Volt ranges : $10\text{M}\Omega \pm 0.1\%$.

INPUT CURRENT (1 year)

$< 50\text{pA}$ drifting at $< 2\text{pA}/^\circ\text{C}$.

RESISTANCE

Full Range Count : 100,000 (1,000,000)
 Full Scale Count : 199,999 (1,999,999)
Superfast Mode Full Scale Count : 19,999

ACCURACY

24 HOURS (23°C $\pm 1^\circ\text{C}$)

*10 Ω range:	$\pm 15\text{ppm}$ of reading ± 2 digits (16)
0.1k Ω , 1k Ω , 10k Ω ranges:	$\pm 10\text{ppm}$ of reading ± 1 digit (8)
100k Ω range:	$\pm 15\text{ppm}$ of reading ± 1 digit (8)
1000k Ω range:	$\pm 30\text{ppm}$ of reading ± 1 digit (8)
10M Ω range:	$\pm 150\text{ppm}$ of reading ± 1 digit (8)

90 DAYS (23°C $\pm 5^\circ\text{C}$)

*10 Ω range:	$\pm 40\text{ppm}$ of reading ± 2 digits (16)
0.1k Ω , 1k Ω , 10k Ω ranges:	$\pm 30\text{ppm}$ of reading ± 1 digit (8)
100k Ω range:	$\pm 40\text{ppm}$ of reading ± 1 digit (8)
1000k Ω range:	$\pm 100\text{ppm}$ of reading ± 1 digit (8)
10M Ω range:	$\pm 300\text{ppm}$ of reading ± 1 digit (8)

1 YEAR (23°C $\pm 5^\circ\text{C}$)

*10 Ω range:	$\pm 60\text{ppm}$ of reading ± 2 digits (16)
0.1k Ω , 1k Ω , 10k Ω ranges:	$\pm 45\text{ppm}$ of reading ± 1 digit (8)
100k Ω range:	$\pm 60\text{ppm}$ of reading ± 1 digit (8)
1000k Ω range:	$\pm 200\text{ppm}$ of reading ± 1 digit (8)
10M Ω range:	$\pm 500\text{ppm}$ of reading ± 1 digit (8)

Superfast Mode : As DC Volts

TEMPERATURE COEFFICIENT : (10°C to 35°C)
 1/10th of 90 DAY specification $\pm 100\mu\text{V}/^\circ\text{C}$

READ RATE

Normal Mode
 All ranges : As DC Volts.
Superfast Mode : As DC Volts

TYPE

True 4-wire with active guard (can be switched to 2-wire on the front panel).
 Measurement technique is independent of the internal reference voltage.

OPEN CIRCUIT VOLTAGE

< 10 volts on all ranges

LEAD RESISTANCE

Up to 100 Ω may be tolerated in any or all the leads on any range. (Rejection of lead resistance is 100dB on any range).

RESPONSE TIME

Depends on external capacitance and guarding/shielding techniques used.
 Generally up to 10k Ω response as DC Volts.
 Higher resistances take longer to settle.
 OHMS GUARD may be used to guard out stray capacitance.

CURRENT THROUGH UNKNOWN ($\pm 1\%$)

10 Ω , 0.1k Ω ranges:	10mA
1k Ω range:	1mA
10k Ω range:	100 μA
100k Ω range:	10 μA
1000k Ω range:	1 μA
10M Ω range:	100nA

OHMS GUARD

Drive Capability: I+ or I- to OHMS GUARD,
 250 Ω minimum (up to 10 Ω lead resistance).
 Guarding Accuracy : See Section 2 - 'Resistance measurement'.

*Within 15 minutes of 'Input Zero' correction and 'Input Filter' selected or add 5 μV per year

[1] or < 3 digits or 1ppm of step size (whichever is greater) following a range change

[5] Count and Accuracy figures in brackets refer to 1061A in 'Filter' Mode (6½ digits)

NOTE: SUPERFAST selected by remote programming only

1061 Specifications (cont.)

AC VOLTAGE (TRUE RMS – OPTION 10)

Full Range Count : 100,000

Full Scale Count : 199,999 on all ranges except 1000V range

ACCURACY (Signals $< 2 \times 10^7$ Volt Hz, $> 0.25\%$ Full Scale)

DC + 45Hz [2] to 5kHz

24 HOURS (23°C ± 1°C) Relative to calibration standards.

0.1V and 1000V ranges:

± 0.04% of reading ± 40 digits

1 to 100V ranges:

± 0.02% of reading ± 20 digits

90 DAYS (23°C ± 5°C)

0.1V and 1000V ranges:

± 0.08% of reading ± 40 digits

1 to 100V ranges:

± 0.04% of reading ± 20 digits

1 YEAR (23°C ± 5°C)

0.1V and 1000V ranges:

± 0.12% of reading ± 40 digits

1 to 100V ranges:

± 0.06% of reading ± 20 digits

DC + 5kHz to 100kHz

± 0.1% of reading ± 100 digits

± 0.05% of reading ± 50 digits

± 0.2% of reading ± 100 digits

± 0.1% of reading ± 50 digits

± 0.3% of reading ± 100 digits

± 0.15% of reading ± 50 digits

HF ACCURACY [3] (1 and 10V ranges)

100kHz to 1MHz ± 2% of reading ± 2000 digits (typical)

INPUT IMPEDANCE

1MΩ shunted by 150pF

LF ACCURACY

Filter out, at line frequency add: ± 0.6% of reading

Filter in, 10Hz : ± 2.0% of reading

CONVERSION TYPE

True RMS AC coupled (measures AC component with up to 1000V DC bias on any range, subject to the constraints of Section 2, Table 2.1).

or True RMS DC coupled (measures $\sqrt{AC^2 + DC^2}$)

CREST FACTOR

7 : 1 typically, at full range

SETTLING TIME (DC coupled)

(i) To 0.1% of step size

Filter out < 150mS
Filter in < 500mS

TEMPERATURE COEFFICIENT

< 1/10th of 90 DAY specification/°C

(ii) From DC bias input (AC coupled) or severe overload:
Depends on change of DC bias
(CR time constant 0.22 seconds)

COMMON MODE REJECTION

1kΩ unbalance > 90dB @ DC – 60Hz

READ RATE (with full scale input) : 3 readings/second.

DC CURRENT

(applicable only if option 12 is not fitted)

Full Range Count : ± 100,000

Full Scale Count : ± 199,999

Superfast Mode Full Scale Count: 19,999

ACCURACY

24 HOURS (23°C ± 1°C) Relative to calibration standards

0.1 to 100mA ranges: ± 50ppm of reading ± 4 digits

1000mA range: ± 100ppm of reading ± 4 digits

90 DAYS (23°C ± 5°C)

0.1 to 100mA ranges: ± 100ppm of reading ± 4 digits

1000mA range: ± 200ppm of reading ± 4 digits

1 YEAR (23°C ± 5°C)

0.1 to 100mA ranges: ± 150ppm of reading ± 4 digits

1000mA range: ± 300ppm of reading ± 4 digits

Superfast Mode : As DC volts.

TEMPERATURE COEFFICIENT

1/10th of 90 DAY specification/°C

READ RATE : As DC Volts

SETTLING TIME : As DC Volts

SHUNT RESISTANCE

0.1mA range : 1kΩ

1mA range : 100Ω

10mA range : 10Ω

100mA range : 1Ω

1000mA range : 0.1Ω

Internal lead resistance: < 20% of shunt resistance + 1Ω

INPUT PROTECTION

Overloads : < 2A, internally clamped

≥ 2A, rear panel fuse

AC CURRENT (TRUE RMS)

(in conjunction with option 10 only)

Full Range Count: 100,000

Full Scale Count : 199,999

ACCURACY DC + 45Hz [2] to 5kHz

(Signals > 0.1% Full Scale)

24 HOURS (23°C ± 1°C) Relative to calibration standards

0.1 to 1000mA ranges: ± 0.1% [4] of reading ± 100 digits

90 DAYS (23°C ± 5°C)

0.1 to 1000mA ranges: ± 0.2% [4] of reading ± 100 digits

1 YEAR (23°C ± 5°C)

0.1 to 1000mA ranges: ± 0.3% [4] of reading ± 100 digits

CREST FACTOR

3 : 1 typically, at full range

TEMPERATURE COEFFICIENT

< 1/10th of 90 Day specification/°C

READ RATE : As AC Volts

SETTLING TIME : As AC Volts

SHUNT RESISTANCE : As DC current

CONVERSION TYPE

True r.m.s. AC coupled or DC coupled

INPUT PROTECTION

As DC Current but large DC bias may cause protection to operate as the AC coupling is provided after current shunts.

[2] Read 360Hz instead of 45Hz if 'Input Filter'

not selected.

[3] Spec read-out invalid above 100kHz.

[4] Typical above 1kHz.

HIGH PERFORMANCE AC VOLTAGE (TRUE RMS – OPTION 12)

Full Range Count: 100,000 (1,000,000)

Full Scale Count: 199,999 (1,999,999) on all ranges except 1000V Range

ACCURACY

(For signals $< 2 \times 10^7$ Volt Hz, $> 0.25\%$ Full Scale)

(\pm % reading \pm digits)

DC + 45Hz - 2kHz [2] [5]	2kHz - 30kHz [5] [6]	30kHz - 100kHz [5] [6]
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24 HOURS ($23^\circ\text{C} \pm 1^\circ\text{C}$) Relative to calibration standards

0.1V & 1000V ranges:	0.02 \pm 15(150)	0.04 \pm 30(300)	0.08 \pm 45(450)
1V to 100V ranges:	0.01 \pm 10(100)	0.02 \pm 20(200)	0.04 \pm 40(400)

90 DAYS ($23^\circ\text{C} \pm 5^\circ\text{C}$)

0.1V & 1000V ranges:	0.04 \pm 15(150)	0.08 \pm 30(300)	0.20 \pm 45(450)
1V to 100V ranges:	0.025 \pm 10(100)	0.05 \pm 20(200)	0.10 \pm 40(400)

1 YEAR ($23^\circ\text{C} \pm 5^\circ\text{C}$)

0.1V & 1000V ranges:	0.05 \pm 15(150)	0.10 \pm 30(300)	0.25 \pm 45(450)
1V to 100V ranges:	0.03 \pm 10(100)	0.06 \pm 20(200)	0.15 \pm 40(400)

LF ACCURACY

Filter out, at line frequency: $\pm 0.6\%$ of reading

Filter in, 10Hz : $\pm 2\%$ of reading

HF ACCURACY: 100kHz - 1MHz [3]

1V & 10V Ranges $2\% \pm 2000(20,000)$

DC COUPLING

Add to main specification $0.01\% \pm 3(30) \pm 10\mu\text{V}$.

CONVERSION TYPE

True RMS AC coupled (measures AC component with up to 1000V DC bias on any range, subject to the constraints of Section 2, Table 2.1).

or

True RMS DC coupled (measures $\sqrt{AC^2 + DC^2}$)

CREST FACTOR

5 : 1, at full range

SETTLING TIME (DC coupled)

(i) To 0.1% of step size:

Filter out $< 200\text{ms}$

Filter in $< 1.25\text{s}$

(ii) From DC bias input (AC coupled) or severe overload: Depends on DC bias, (CR time constant 0.22 seconds)

TEMPERATURE COEFFICIENT

$< 1/10$ th of 90 day specification $^\circ\text{C}$

COMMON MODE REJECTION

$1\text{k}\Omega$ source unbalanced: $> 90\text{dB} @ \text{DC} - 60\text{Hz}$

INPUT IMPEDANCE

$1\text{M}\Omega$ shunted by 150pF

READ RATE

With full scale input: 3/s

Notes:

[2] Read 360Hz instead of 45Hz if "Input Filter" not selected

[3] Spec read-out invalid above 30kHz

[5] Count and accuracy figures in brackets refer to 1061A in "Filter" mode (6½ digits)

[6] Add 0.01% per 100V above 500V

Standard internal delays

An internal time delay is introduced between receipt of any trigger pulse and the start of a measurement cycle.

It is therefore possible for a user to apply the trigger and signal simultaneously, knowing that the input circuitry will have settled to the new signal level before the measurement cycle begins.

To optimize maximum read-rate with adequate settling time, the size of the internal delay is standardized for various combinations of function and range selection. These variations are shown in the following tables:

1061/1061A		Filter Out (ms)	Filter In (ms)
Function	Range		
DCV	all	5	500
(Option 12) ACV DCV + ACV	all	300	1250
(Option 10) ACV DCV + ACV ACI DCI + ACI	all	225	750
DCI	100µA-1mA 10mA 100mA 1A	5 10 20 25	500
kΩ	10Ω-100kΩ 1MΩ 10MΩ	5 15 150	500 600 1250

1071		Filter Out (ms)	Filter In (ms)
Function	Range		
DCV DCI	all	50	1000
ACV DCV + ACV ACI DCI + ACI	all	230	750
kΩ	10Ω-100kΩ 1MΩ 10MΩ	50 50 310	1000 1200 2500

In addition to all the delays shown above, two further delays are imposed:

Range change – 10V-100V : 25ms
Function change : 100ms